EXERCISE IV

Go as far as you can!

4.1 Design and write an OldMacdonald class that sings several verses of "Old MacDonald Had a Farm." Use methods to generalize the verses.

Old MacDonald had a farm

Old MacDonald had a farm, e i e i o
And on his farm he had some chicks, e i e i o
with a chick chick here and a chick chick
there
here a chick there a chick
everywhere a chick chick
Old MacDonald had a farm, e i e i o

Old MacDonald had a farm, e i e i o
And on his farm he had some cows, e i e i o
with a moo moo here and a moo moo there
here a moo there a moo
everywhere a moo moo
Old MacDonald had a farm, e i e i o

Old MacDonald had a farm, e i e i o
And on his farm he had some ducks, e i e i o
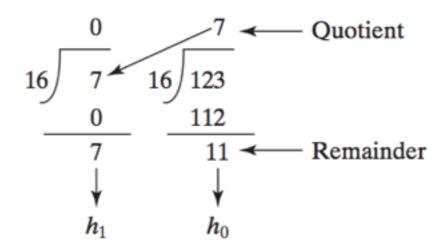with a quack quack here and a quack quack
there
here a quack there a quack
everywhere a quack quack
Old MacDonald had a farm, e i e i o

Old MacDonald had a farm, e i e i o
And on his farm he had some pigs, e i e i o
with an oink oink here and an oink oink there
here an oink there an oink
everywhere an oink oink
Old MacDonald had a farm, e i e i o

4.2 The Fibonacci sequence (named after the Italian mathematician Leonardo of Pisa, ca. 1200) consists of the numbers 0,1,1,2,3,5,8,13,... in which each number (except for the first two) is the sum of the two preceding numbers. Write a method fibonacci(N) that prints the first N Fibonacci numbers.

4.3 Hexadecimals are often used in computer systems programming. Please write a method that converts a decimal integer to a hexadecimal.

For example, the decimal number **123** is **7B** in hexadecimal. The conversion is done as follows:

$$
\begin{array}{r}
0 \qquad\qquad 7 \leftarrow \text{Quotient} \\
16\overline{)7} \quad 16\overline{)123} \\
\underline{0} \qquad\quad \underline{112} \\
7 \qquad\quad 11 \leftarrow \text{Remainder} \\
\downarrow \qquad\quad \downarrow \\
h_1 \qquad\quad h_0
\end{array}
$$

4.4 (Twin primes) Twin primes are a pair of prime numbers that differ by 2. For example, 3 and 5 are twin primes, 5 and 7 are twin primes, and 11 and 13 are twin primes. Write a program to find all twin primes less than 1000. Display the output as follows:

(3, 5)
(5, 7)
…